




# Anemia and iron deficiency in primigent parturients in a municipality of Brazilian west Amazon

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## Abstract

To analyze the prevalence of anemia and associated factors in primiparous parturient.

Cross-sectional study conducted in a municipality of the Brazilian Western Amazon from July 2014 to December 2015. A convenience sample of 461 first-time pregnant women were interviewed. Data on their sociodemographic, clinical, obstetric, personal habits and nutritional status were collected. Anemia and iron depletion were measured by peripheral blood collection with hemoglobin, hematocrit, serum ferritin and transferrin saturation index. To test the association between the variables, the  $\chi^2$  tests were applied and Poisson regression analysis with a 95% confidence interval was performed, and  $P < .05$  values were considered significant. The Forward stepwise strategy was used to construct the adjusted model. These analyzes were performed using the STATA 14.0 program (College Station, TX, 2013).

A higher risk of anemia was identified among adolescent; white; who had a partner; with unpaid occupation, with less than eight years of formal education. Residents in the countryside; smokers; who had more than six prenatal consultations and were overweight.

Anemia was reported in 28.20% and iron depletion in 60.52% of parturient women. The variables studied did not have association with the anemia outcome, except alcohol consumption.

**Abbreviations:**  $\mu\text{g}$  = micrograms, BMI = body mass index, CI = confidence interval, dL = deciliter, Fe = serum iron, g = Grams, Hb = hemoglobin, HDI = human development index, Ht = hematocrit, MCHC = mean corpuscular hemoglobin concentration, MCV = mean corpuscular volume, mg = milligrams, ml = milliliter, PNC = prenatal care, PR = prevalence ratio, Stata = software for statistics and data science, TIBC = total iron binding capacity, TS = transferrin saturation index, WHO = World Health Organization.

**Keywords:** anemia, epidemiology, iron deficiency, pregnancy, iron, ferritin

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The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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## 1. Introduction

Iron deficiency anemia is a worldwide nutritional problem and a barrier to maternal health.<sup>[1,2]</sup>

Iron deficiency reflects the inability of erythropoietic tissue to maintain normal hemoglobin (Hb) concentration due to inadequate iron supply resulting from depletion of mineral reserves in the body. This change interferes with oxygen transport impairing physiological functions.<sup>[3,4]</sup>

During pregnancy, hemoglobin values below 11 g per 100 ml of blood (11 g/dL) are considered anemia, and may be triggered by multiple factors such as malnutrition, parasitic infection, chronic inflammation and hereditary diseases. However, studies highlight that about 50% of anemia cases are associated with insufficient iron intake.<sup>[1-5]</sup>

Although all population groups are subject to iron deficiency, women, because of their physiological characteristics during pregnancy constitute the most vulnerable group for the development of anemia, with risks to mother's and child's health.<sup>[1,6,7]</sup> Anemic pregnant women have a higher risk of impaired physical and mental performance, preeclampsia, cardiovascular changes, lower tolerance to blood loss at delivery and higher risk of mortality.<sup>[2,8]</sup> For the fetus, maternal anemia can cause miscarriage and intrauterine death, fetal hypoxemia, prematurity, low birth weight with risk of irreversible neuro-developmental disorders.<sup>[2,3,9]</sup>

The Pan American Health Organization suggests that 42% of pregnant women in Brazil are anemic. In Northeastern region, gestational anemia is estimated to be between 30-40%, mainly affecting women of low socioeconomic status.<sup>[1,6,7]</sup> In the North Region, a study reports anemia prevalence of 32.2% before iron flour fortification, reducing it to 24.9% after this intervention.<sup>[10]</sup> In the state of Acre, a study conducted in the city of Cruzeiro do Sul, identified a prevalence of 17.5% anemia in third trimester pregnant women.<sup>[11]</sup>

Public health plays a key role in identifying determinants of the health-disease process, aids in prevention and control, and guides decision-making to improve a population's quality of life. Studying and monitoring the magnitude of anemia and its predictors in vulnerable populations, as pregnant women, is of great importance, as it allows the identification of its multiple causes, guiding strategy planning and maximizing decisions that minimize the risks to maternal and child health.<sup>[1,12]</sup>

Thus, the aim of this study was to analyze the prevalence of anemia and associated factors in primiparous parturients in a municipality of the Brazilian Western Amazon.

## 2. Materials and Methods

### 2.1. Study design and local

Cross-sectional study conducted in a public hospital unit, a reference for maternal and child care, located in the city of Cruzeiro do Sul, Acre State, Western Brazilian Amazon. Data collection was performed from July 2014 to December 2015.

### 2.2. Sample study

Considering the variation in the prevalence of anemia in different regions of the country, including the northern region, a prevalence of 50.0% was estimated, with a 5% margin of error

and 95% confidence level. The sample was calculated with the next formula (2):

$$N = \frac{Z^2 * P(1 - P)}{\varepsilon^2}$$

Where:

N = Minimum sample size;

P = estimation of the true proportion of anemia in pregnancy.

In the case, P = 0.50

$\varepsilon$  = sampling error, assuming a value of 0.05 (5%).

Z = abscissa of the standard normal curve, set a confidence level of 95%, resulting in Z = 1.96.

There is:

$$N = \frac{1,962 * 0,50(1 - 0,50)}{0,05^2}$$

N = 384.16

Predicting the possibilities of losses, the sample size was increased by 10.0% totaling a minimum number of 423 parturients. However, it was possible to achieve a group of 461 women who met the inclusion criteria and comprised the final sample.

### 2.3. Inclusion criteria

There were included primiparous women with single-fetal pregnancy participated during the first clinical period of labor (active phase dilation), at term (37 to 42 weeks of gestation), attended at least three antenatal consultations and holders of a follow up card of prenatal care.

### 2.4. Exclusion criteria

There were excluded women who received blood transfusion during pregnancy, those with maternal and obstetric morbidities at admission (hematological diseases except anemia, diabetes, hypertension, placenta previa, premature placental detachment, chorioamnionitis, infectious diseases) and with cognitive impairment.

### 2.5. Data collection procedure

First, it was performed a screening of pregnant women admitted to the obstetric center in effective labor (pre-delivery). Parturients who met the eligibility criteria had their medical records labeled with the word "selected". The availability of their blood samples taken on the routine admission procedure was verified.

The interviews were conducted six hours after delivery, in order to not interfere with the parturition process and respecting maternal recovery. It was applied a standardized and pre-coded script containing sociodemographic data, clinical history, personal history, gynecological, current pregnancy and nutritional status - defined by Body Mass Index (BMI) classified according to gestational week as underweight, adequate weight, overweight and obesity.<sup>[13]</sup>

Hematological data (complete blood count) were obtained by an automatic hematology analyzer SDH-20standard, reference BN, serial number 1303.5 which uses only two reagents (diluent and hemolysant), impedance methodology and cyanide-free photometry (hemoglobin). From the values found, the Mean Corpuscular Hemoglobin Concentration (MCHC) was calculated by the

percentage relation between Hb and hematocrit (Ht). Mean Corpuscular Volume (MCV), by the hematocrit ratio by the number of erythrocytes multiplying by 10.

For biochemical analysis, the blood samples were homogenized and centrifuged. The reading was performed by a Labmax Model 240 automated analyzer. Serum Ferritin (Fs) was analyzed by the immunoturbidimetry method with the Ferritina Turbiquest Plus kit. Serum iron was determined by the colorimetric method with the Fe Liquiform kit. The total iron binding capacity was analyzed by the colorimetry method with the IBC Liquiform kit.

Transferrin Saturation Index (TS) was determined by the serum iron (Fe) to total iron binding capacity (TIBC) ratio x 100.

The gestational anemia parameter was defined as hemoglobin levels categorized as normal Hb  $\geq 11$  g/dL and with anemia Hb  $< 11$  g/dL subdivided into: mild anemia - Hb 10 to 10.9 g/dL; moderate - Hb 7.0 to 9.9 g/dL and severe - Hb  $< 7$  g/dL.<sup>[8]</sup> Serum ferritin values  $< 30$   $\mu$ g/dl were considered to define iron deficiency.<sup>[1,14]</sup> Other parameters used had their normal values defined according to the existing literature.<sup>[5,14-16]</sup>

## 2.6. Data analysis

Data were analyzed with the software STATA 14.0 (College Station, TX, 2013). The information obtained was distributed in absolute and relative frequency, confidence interval, mean, minimum, maximum and standard deviation.

To verify the association between independent variables and anemia, the  $\chi^2$  tests were applied and Poisson regression analysis was performed, estimating the following measures: Prevalence ratio (PR) with a 95% confidence interval (95% CI), with *P* values  $< .05$  being considered significant. The adjusted model was constructed through the forward stepwise strategy.

## 2.7. Ethical considerations

The study complied with ethical recommendations and was approved by the Research Ethics Committee of the Federal University of São Paulo under protocol 17541913.0.0000.5505. All women who comprised the sample signed an informed consent form.

## 3. Results

A total of 461 primiparous parturients with a mean age of 20.59  $\pm$  4.86 years (min. 13 and max. 38 years) were evaluated. Out of them, 52.28% (241) were adolescents, of these, 58.9% (142) aged 17 years or less.

Considering the general characteristics of the sample, the majority 77.66% (358) self-declared brown, 64.43% (297) lived in a stable relationship with a partner, 80.48% (371) had unpaid activities, 75.92% (350) lived in the surrounding area, 99.13% (457) denied smoking and 96.53% (445) consumed alcohol.

Educational level, in years of schooling, was higher than eight for 78.31% (361) of the participants. Only 0.43% (02) of them had no formal education and 15.18% (70) had completed or had started higher education. Regarding the number of prenatal consultations, 78.96% (364) attended an average of 7.45 which is the recommended by the pre natal care.

A statistically significant dependence relationship was observed between hemoglobin and hematocrit, it was verified when this relation was recorded by the MCHC (Table 1).

Among the biochemical indicators, there was no statistically significant association. Anemia was observed in 28.20% (130) with a mean hemoglobin of 11.61 g/dL  $\pm$  1.16. Iron deficiency, considering Fs values, was identified in 59.23% (77) of the anemic and 72.31% (94) of these showed an increase in

**Table 1**

**Mean, SD, hematological parameters and iron reserves in primigent parturients with or without anemia attended at a referral maternity hospital. Cruzeiro do Sul, Acre, Brazilian Western Amazon, 2014-2015.**

Hematological Parameters	Average ( $\pm$ SD) Hb $< 11$	Average ( $\pm$ SD) Hb $\geq 11$	General Average ( $\pm$ SD)	Anemia Hb/Average = 11,61 ( $\pm$ 1,16)				Value <i>P</i> *
				YES 28,20% (N=130)		NO 71,80% (N=331)		
Hematocrit	31.49( $\pm$ 1.87)	37.12 ( $\pm$ 2.59)	35.53 ( $\pm$ 3.49)					
< 33%				75.38	98	24.62	12	<.001
$\geq 33\%$				3.63	32	96.37	319	
Mean Corpuscular Volume (MCV)	81.49 ( $\pm$ 6.81)	86.53 ( $\pm$ 4.81)	85.1 ( $\pm$ 5.90)					
< 80 fL				39.23	51	8.76	29	<.001
$\geq 80$ fL				60.77	79	91.24	302	
Mean Corpuscular Hemoglobin Concentration (MCHC)	32.39 ( $\pm$ 0.83)	32.79 ( $\pm$ 0.95)	32.7 ( $\pm$ 0.90)					<.001
< 33%				76.15	99	61.33	203	
$\geq 33\%$				23.85	31	38.67	128	
Serum Ferritin (SF)	35.70 ( $\pm$ 41.93)	35.30 ( $\pm$ 68.12)	35.41 ( $\pm$ 61.76)					.722
< 30 $\mu$ g/dL				59.23	77	61.03	202	
$\geq 30$ $\mu$ g/dL				40.77	53	38.97	129	
% transferrin saturation	23.99 ( $\pm$ 11.91)	22.88 ( $\pm$ 11.45)	23.20 ( $\pm$ 11.57)					.398
< 16%				27.69	36	31.72	105	
$\geq 16\%$				72.31	94	68.28	226	
Serum iron	90.55 ( $\pm$ 34.80)	89.33 ( $\pm$ 55.25)	89.67 ( $\pm$ 50.30)					.205
< 67 $\mu$ g/dL				23.36	25	76.64	82	
$\geq 67$ $\mu$ g/dL				29.66	105	70.34	249	

$\mu$ g = micrograms, dL = deciliter, fL = femtoliter, Hb = hemoglobin, SD = standard deviation.

\* $\chi^2$  test, *P* value considered *P*  $< .05$ .

transferrin saturation confirming iron deficiency anemia. It is noteworthy that 61.03% (202) of non-anemic individuals were identified with iron deficiency (Table 1).

Prevalence of anemia according to the independent variable categories and their respective crude prevalence ratios (95% CI) and factors associated with anemia after adjustment of the final multiple model are presented in Table 2.

Univariate analysis did not identify factors associated with anemia. Adjusted multiple analysis, considering possible confounding factors, confirmed the absence of significant association

for most independent variables, except for the variable alcohol consumption (Table 2).

Considering the sociodemographic characteristics, it stands out a lower proportion of anemia among non-white parturients with more than 20 years of age, with a paid occupation. A higher proportion was identified among those with less than eight years of educational level, who lived with a partner and residents of the Rural Zone (Table 2).

Regarding clinical characteristics and personal habits, women who reported being smokers, having a regular menstrual cycle

**Table 2**

**Gross and adjusted analysis of anemia prevalence and associated factors in primigent parturients in a logistic regression model – Brazilian Western Amazon, Acre, Brazil, 2014-2015.**

Variables	Anemia n = 130 (28,2%)	Univariate		Multiple	
		PR gross (IC95%)	Value P <sup>*</sup>	PR adjusted (IC95%)	Value P <sup>†</sup>
Age group					
≤ 19 years	68 (52.31)	1		1	
> 20 years	62 (47.69)	0.99 (0.75–1.33)	.994	1.07 (0.76–1.51)	.695
Self-reported color					
White	21 (16.15)	1		1	
Not White	109 (83.85)	0.82 (0.56–1.21)	.317	0.94 (0.63–1.41)	.762
Marital situation					
No partner	40 (30.77)	1		1	
With partner	90 (69.23)	1.24 (0.90–1.71)	.184	1.29 (0.92–1.75)	.151
Schooling in years					
> 8 years	98 (75.38)	1		1	
≤ 8 years	32 (24.62)	1.18 (0.90–1.71)	.332	1.21 (0.85–1.71)	.288
Occupation					
Unpaid	108 (83.08)	1		1	
Paid	22 (16.92)	0.84 (0.56–1.25)	.388	0.85 (0.55–1.31)	.462
Area of domicile					
Urban	98 (75.38)	1		1	
Rural	32 (24.62)	1.03 (0.56–1.25)	.865	1.08 (0.77–1.52)	.652
Smoking					
No	128 (98.46)	1		1	
Yes	2 (1.54)	1.79 (0.66–4.81)	.252	2.75 (0.55–13.75)	.217
Alcohol consumption					
No	128 (98.46)	1		1	
Yes	2 (1.54)	0.43 (0.12–1.60)	.211	0.37 (0.14–0.97)	.043
Menstrual cycle					
Not regular	17 (13.08)	1		1	
Regular	113 (86.92)	1.15 (0.74–1.79)	.534	1.18 (0.76–1.81)	.460
Absenteeism at work					
No	95 (73.08)	1		1	
Yes	35 (26.92)	1.35 (0.98–1.85)	.066	1.30 (0.94–1.79)	.114
1st PNC GA					
≥ 13 weeks	61 (46.92)	1		1	
< 13 weeks	69 (53.08)	0.91 (0.68–1.22)	.545	0.89 (0.64–1.22)	.464
Number of PNC visits					
< 6	29 (22.31)	1		1	
≥ 6	101 (77.69)	0.93 (0.66–1.31)	.674	0.97 (0.66–1.42)	.884
Antianemic Supplement					
No	10 (7.69)	1		1	
Yes	120 (92.31)	1.27 (0.72–2.23)	.414	1.27 (0.70–2.29)	.435
Nutritional Status at the End of Pregnancy <sup>‡</sup>					
Adequate	54 (42.52)	1		1	
Low weight	35 (27.56)	1.08 (0.76–1.54)	.672	1.05 (0.74–1.51)	.767
Overweight	30 (23.62)	1.11 (0.77–1.61)	.579	1.11 (0.76–1.63)	.579
Obesity	8 (6.30)	0.69 (0.35–1.33)	.266	0.69 (0.35–1.34)	.276

CI95% = 95% confidence interval, GA = gestational Age, PNC = pre-natal consultation, PR = prevalence ratio.

\* Gross Poisson Regression.

† Adjusted Poisson Regression,  $P < .05$  as significant.

‡ Variable with missing information

and being absent from work due to uterine bleeding showed a higher risk of developing anemia (Table 2).

Regarding prenatal characteristics, although a similar magnitude of risk is observed between the groups, having more than six consultations with the first visit in the first gestational trimester reduces the risk of anemia. The proportion of anemia among women who used anti-anemic supplementation was 1.27 times higher than non-supplemented women (Table 2).

Observing the nutritional status, the prevalence of anemia was identified among women with adequate weight (42.52%), but the highest risk of anemia stands out in those with overweight (Table 2).

#### 4. Discussion

The frequency of anemia in the primigent parturients studied was 28.20%, higher than the one reported by a research conducted in the same region by Campos et al,<sup>[11]</sup> which reached 17.2%. In turn, our result is below the global estimate for gestational anemia (38.2%) and is also under the value found in developing countries (30 to 40%).<sup>[1]</sup> Most of the anemia cases, 69.23% (90) were classified as mild, 30.77% (40) as moderate and there were no records of severe cases.

The prevalence of anemia in Brazil ranges from 5% to high percentages considered severe (> 40%).<sup>[6,16-26]</sup> The data from current study corroborate the prevalence of anemia found in other municipalities in the North<sup>[18]</sup> and Northeast<sup>[19,21]</sup> regions, whose human development index (HDI)<sup>[27]</sup> are similar and above the percentage found in the South,<sup>[20,22,25]</sup> demonstrating that anemia is distributed in different ways, considering the geographic and socioeconomic diversity of each territory.

The mean Hb value (11.6 g/dL) is close to the world average (11.4 g/dL).<sup>[28]</sup> It was similar to the values reported for national and northern Brazil, in a study that evaluated anemia before (11.8 g/dL and 11.9 g/dL) and after (11.5 g/dL and 11.79 g/dL) iron flour fortification in the five Brazilian regions.<sup>[10]</sup>

Considering the World Health Organization (WHO) classification,<sup>[1]</sup> anemia in the municipality of Cruzeiro do Sul represents a moderate public health problem (20%–39.9%).

Iron deficiency occurred in 59.23% (77) of anemic parturients confirming iron deficiency anemia. Corroborating the study by Baingana,<sup>[29]</sup> it was equally significant among non-anemic women 61.03% (202), evidencing the importance of complementing the investigation of anemia with serum ferritin dosage for timely screening of this hematological change during pregnancy and labor, considering that the isolated use of these parameters does not clarify other causes of anemia and iron depletion.<sup>[5,9]</sup> In addition, serum ferritin is considered the standard parameter for the diagnosis of iron deficiency anemia.<sup>[1,9,15,28]</sup>

Regarding the age group, the occurrence of anemia was higher among pubertal, different from what was found by Campos et al<sup>[11]</sup> where, in addition to demonstrating an association between age and outcome, anemia was more frequent among those women over 19 years of age.

The higher prevalence of this malnutrition in adolescents may be related to the proportion of this age group that was above 50% of the sample analyzed. There are several studies that corroborate a higher prevalence of anemia in this group.<sup>[10,17]</sup> The Northeast, showed a higher risk of developing anemia in pregnant women ≤19 years.<sup>[19]</sup> In adolescents, the occurrence of anemia is increased due to the rapid body growth, onset of

menstrual cycle and poor diet, increasing the risk of nutritional deficiencies.<sup>[6,17]</sup>

The significant occurrence of anemia among self-reported non-white women (consisting mainly of brown and black women) also evidenced by Campos et al,<sup>[11]</sup> it was expected in this investigation and may be justified by the ethnic-racial identity of the municipality studied where 60% of the population is classified as brown and black.<sup>[27]</sup>

In addition, recent studies suggest that the black population have levels of hemoglobin and hematocrit (between 0.5 and 1 g/dL) lower than the white people becoming susceptible to anemia. However, these differences are not well defined and the lack of evidence does not allow the establishment of different hemoglobin normality references between races.<sup>[30]</sup>

Higher risk was identified in women with less than eight years of formal education, with a partner and without paid occupation, the latter being an expected outcome in the population studied considering the high proportion of adolescents. Fujimori et al,<sup>[10]</sup> identified a higher frequency of anemia in pregnant women without partners and with a level of education higher than elementary school. Stephen et al,<sup>[2]</sup> point out that low education and low income limit access to nutritious diets.

Approximate risks were observed among parturients living in urban and rural areas. The rural exodus, the ability to produce their own food with access to natural products, the bustling life in urban centers with higher access to industrialized products are points to consider when discussing the differences between the prevalence of anemia in urban and rural areas.<sup>[31]</sup>

Lower educational level, brown or black skin color, household composition in relation to the number of people and age group of residents (under 18 years, not having a formal occupation and living in rural areas) configure higher chances of food insecurity, which is highly related to increased risk of anemia.<sup>[31]</sup>

The risk of anemia was discreetly identified in parturients with a regular menstrual cycle. This may be associated with regular blood loss, as an irregular cycle can be characterized by both long periods of blood loss and absence of uterine bleeding. Women are known to have reduced iron reservations compared to men because of their menstrual cycle. Menstrual hyperflow is a major cause of iron deficiency and consequent anemia.<sup>[32]</sup>

A study of premenopausal women revealed that abnormal uterine bleeding is a significant predictor of iron status, and identifying women with high loss and prenatal eumenorrheic cycles may be an interesting strategy for preventing this deficiency.<sup>[33]</sup>

In this study, smoking and drinking habits should be closely analyzed. Smoking revealed a 79% risk of developing anemia compared with nonsmokers. However, alcohol consumption showed significantly associated with anemia. However, it is believed that this association may occur at random due to the low frequency of those who assumed the habit of drinking and/or smoking. Possible information biases should also be considered, since the data were obtained by in-person interview and the negative answer may have occurred due to shame or fear, because drinking during pregnancy is stigmatized.

It is noteworthy that some drugs, such as alcohol and cigarettes, may interfere with hematimetric values and further investigation is necessary for the diagnosis of anemia.<sup>[1,30]</sup>

Regarding the characteristics of prenatal care (PNC), some studies that evaluated the trimester of first consultation<sup>[34]</sup> and iron supplementation<sup>[6,7,19,21]</sup> corroborate the results of our research where the anemic parturients had their first consultation in the first trimester and took antianemic supplement.

In relation to total number of PNC consultations, similar results were pointed out by Fujimori et al,<sup>[10]</sup> who reported that the risk of anemia is higher among those women who performed less than 6 sessions.

The daily supplementation of 30 to 60mg of elemental iron and 400g (0.4mg) of folic acid, performing at least 6 consultations of PNC (currently updated to a minimum of 8) and PNC initiated at less than 12 gestational weeks, are part of the WHO recommendations for pregnant women to prevent maternal anemia and neonatal outcomes such as prematurity and low birth weight.<sup>[6,35]</sup> A recent study identified that iron supplementation positively impacts the psychological health and quality of life of pregnant women.<sup>[4,35]</sup>

The prevalence of anemia was not associated with the nutritional status of parturients. Higher frequency was identified in those women who had adequate weight, with slightly higher risk among those with overweight. Distinct results have been reported in other studies.<sup>[10,34]</sup> Anemia is frequent in low-weight pregnant women, but the nutritional status considered was pre-gestational or early pregnancy and was associated with the outcome.<sup>[10]</sup> Oliveira et al<sup>[19]</sup> when assessed gestational BMI, identified a higher prevalence in eutrophic pregnant women, but it was in underweight that the correlation with anemia was evidenced which may compromise maternal and fetal health according the authors.

Considering the initiation of prenatal care in a timely manner, with adequate number of consultations and the use of antianemic supplementation, the reported anemia rates are still high. This study had some limitations such as lack of consistent information on adherence of iron salt treatment; regimen adopted, availability of medicines and other factors such as food insecurity and culture, nutritional education, presence of infections and care failures, highlighting a gap that requires further investigation.

It is noteworthy that both anemic and non-anemic parturients had iron deficiency despite similar clinical, sociodemographic and obstetric factors, indicating that health promotion should begin with preconception, with pregnancy planning and prior identification of anemia etiology with early and appropriate intervention.

For anemic women without iron deficiency, it should be maintained an alertness for infectious diseases such as Malaria and Viral Hepatitis which are epidemic in the region studied and may represent other etiological sources of epidemiological importance of anemia.

## 5. Conclusions

The prevalence of anemia among primigent parturients in a municipality of Acre State was 28.2%. Iron deficiency was identified in 60.52%. Only the variable consumption of alcohol remained associated with anemia, but caution should be taken in interpreting this data, considering the low variability of the sample of alcohol users and possible bias in the information provided in the in-person interviews.

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## Author contributions

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